CHAPTER

7

BUILDING CONSTRUCTION

Classification of buildings, Types of loads acting on buildings, Building components and their functions and nominal dimensions.

7.1 INTRODUCTION :

Building or house is one of basic necessities of life. Every one wishes to live in a splendid building and also wishes to own a building or house however small or big it may be. It is also an indicator of civilization the social status and progress of a country.

The primitive man was using mountanious caves and hollows of trees as a shelter. But, then he followed the art of nature and constructed his first home as 'hut', using bamboos and leaves, as the first Civil Engineering construction carried out to satisfy the needs for a shelter. Now the art of creating the structure which was a shelter in the primitive stages, employed modern techniques to make the structure satisfy the practical needs as well as to meet the aesthetical requirements. A man conceived an idea of the intended structure, assessed the requirements in accommodation, planned and designed the structure to suit its purpose giving due thought to site, climate, requirements and style of the building.

Construction techniques also effect the economy as well as quality. As a civil engineer is mainly concerned with the construction of buildings, it is necessary for him to acquire good knowledge of construction of various components of a building. In this chapter building and its classification, loads acting on building and building components with their functions and dimensions have been discussed briefly.

7.2 CLASSIFICATION OF BUILDINGS (TYPES OF BUILDINGS) :

National Building code of India defines the building as "any structure for whatsoever purpose and of whatsoever materials constructed and every part there of whatever used for human habitation or not, and includes all the structural elements like foundations, plinth, walls, floors, roofs, etc. with all building services like w.c., bath, stair, etc."

Buildings are classified as follows :

(i) Based on occupancy (purpose served by buildings)

(ii) Based on structure (according to structural system)

7.2.1 Classification based on occupancy (Purpose served by building) :

(G.T.U., March 2009, June 2009)

As per National Building Code of India, buildings are classified, based on occupancy, as follows :

Group A : Residential buildings

Group B : Educational buildings

Group C : Institutional buildings

Group D : Assembly buildings

Group E : Business buildings

Group F : Mercantile buildings

Group G : Industrial buildings

Group H : Storage buildings

Group J : Hazardous buildings

Group A : Residential Buildings : All those buildings in which sleeping accommodation is provided for dwelling permanently or temporarily with or without cooking or dining facilities are called residential buildings. Examples : Bunglows, flats, row houses, villas, cotages, dormitories, etc.

Group B : Educational Buildings : All those buildings which are meant for imparting training or providing educational facilities right from nursery or primary to university level such as schools, colleges, universities, training institutions, polytechnics, engineering colleges, medical college, libraries, etc.

Group C : Institutional Buildings : These buildings are dealings health care. This group of buildings include such buildings or part thereof for the

purpose such as medical, health, recovering health after illness, physical and mental diseases, care of infants or aged, penal detention etc. These buildings are hospitals, dispensaries, homes for aged people, orphanages, jails, prisons, mental hospitals, reformatories, etc.

Group D : Assembly Buildings : This group includes any building or part of a building where group of people assemble or gather for amusement, recreation, social, religious, patriotic or such other purposes. Assembly halls, exhibition halls, theaters, cinema halls, auditorium, places of worship such as temples, mosques, churches, etc. are the examples of these categories of buildings.

Group E : Business Buildings : This group includes any building or part of a building which is used for purposes such as transaction of business, keeping of accounts and records, etc. Business buildings are banks, offices, barber shops, beauty parlours, lunch counters, etc.

Group F : Mercantile Buildings : These include any building or part of a building, which is used as shops, stores, markets, for display and sale of merchandise, either wholesale or retail.

Group G : Industrial Buildings : These include any building or part of a building, or structure in which products or materials of all kinds and properties are fabricated, assembled or processed. The examples of these buildings are factories, workshops, laboratories, pumping stations, refineries, gas plants, mills, dairies, etc.

Group H : Storage Buildings : This group of building include those structures which are primarily meant for storage of goods, products, wares, merchandise (not combustible), vehicles, animals, etc. The examples of these buildings are cold storages, ware houses, transit sheds, godowns, garages, hangars, etc.

Group J : Hazardous Buildings : This group includes all those buildings or structures which are used for storage, handling and manufacture or processing of materials which are combustible liable to burn or explode and prove hazardous. Hazards may be due to fire, poison, fumes, gases, ignition, etc. and they include magazines, specially prepared stores, etc.

7.2.2 Classification Based on structure : (G.T.U., March 2009, June 2009)

According to structural system there are three types of buildings :

(i) Load bearing structure

(ii) Framed structure

(iii) Composite structure

(i) Load bearing structure :

It is a structure comprising of slabs, beams and load bearing walls. As shown in fig. 7.1 loads from the slab/roof or trusses and floors are transmitted through walls to the sub-soil below the ground through their foundations. Most of the residential buildings are small in size and are up to three storey are generally constructed as load bearing structures. In load bearing structures thickness of walls reduces from ground floor to first floor and so on as loads reduce on walls vertically from ground floor to first floor and first floor to second floor and so on. As a result compared to upper floors, the carpet area at lower floors will be less. Such type of structures are most suited where hard strata of soil is available at shallow depth. Generally individual residential bungalow, tenement, low rise flats (upto three storey), temples and rural buildings are constructed as load bearing structure.

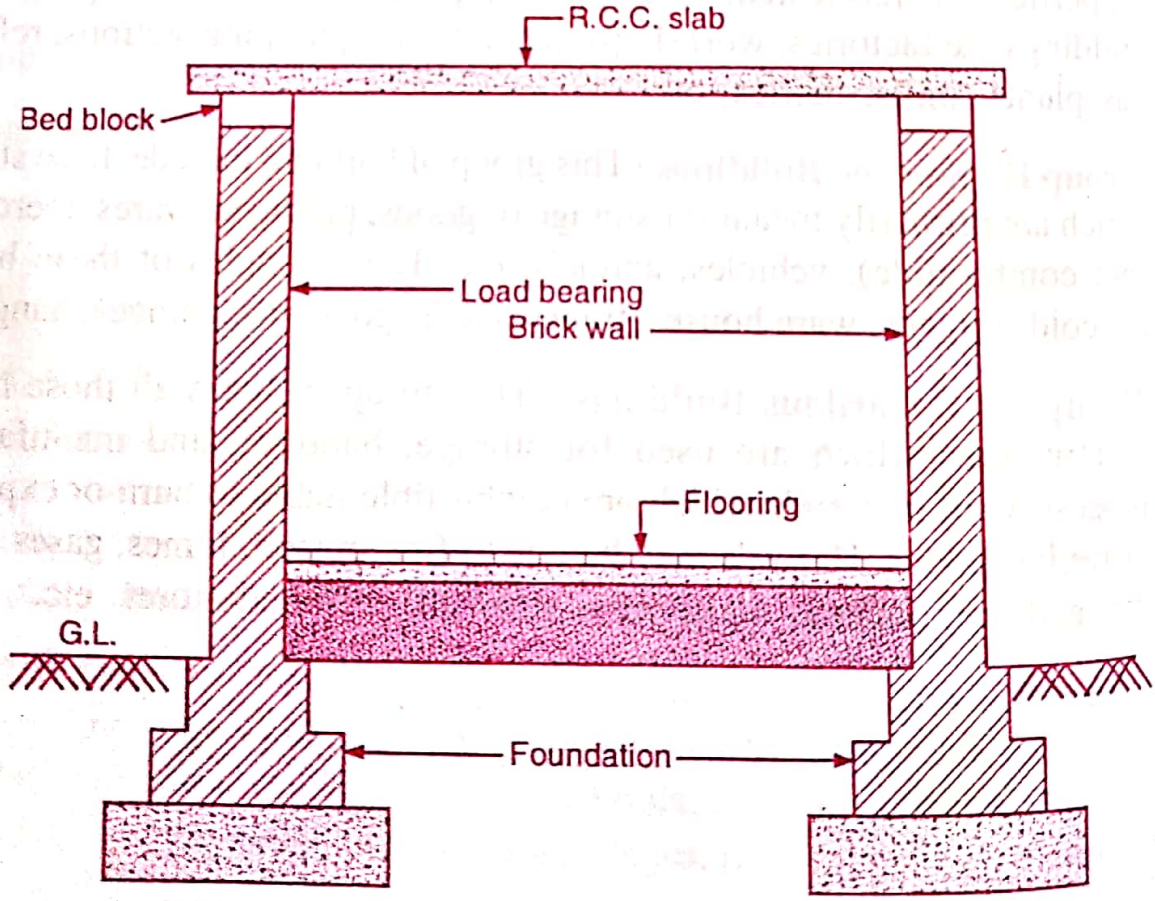


Fig. 7.1 Load bearing tructure

(ii) Framed structure :

(G.T.U., March 2009)

It is a structure comprising of slabs resting on beams and beams are supported by a network of columns. As shown in fig. 7.2 loads from the slabs are transferred to the beams and beams rest over columns and whole load of the structure is transferred to the sub-soil below the ground through columns and their footings. In this structure all the walls may or may not be partition walls as none of them bear any load and rest on plinth beams without foundations.

As partition walls can be shifted easily anywhere on the floor, more flexibility is available while planning a framed structure. R.C.C. is the most suitable material to withstand external loads like compressive, tensile, torsion and shear along with moment, so all framed structures are constructed with R.C.C.. All the columns, beams and slabs are connected rigidly and are constructed monolithically. As carpet area is almost same for all the floors, more carpet area is available than the load bearing structure. Generally all multistored buildings or high-rise buildings are constructed as framed structure.

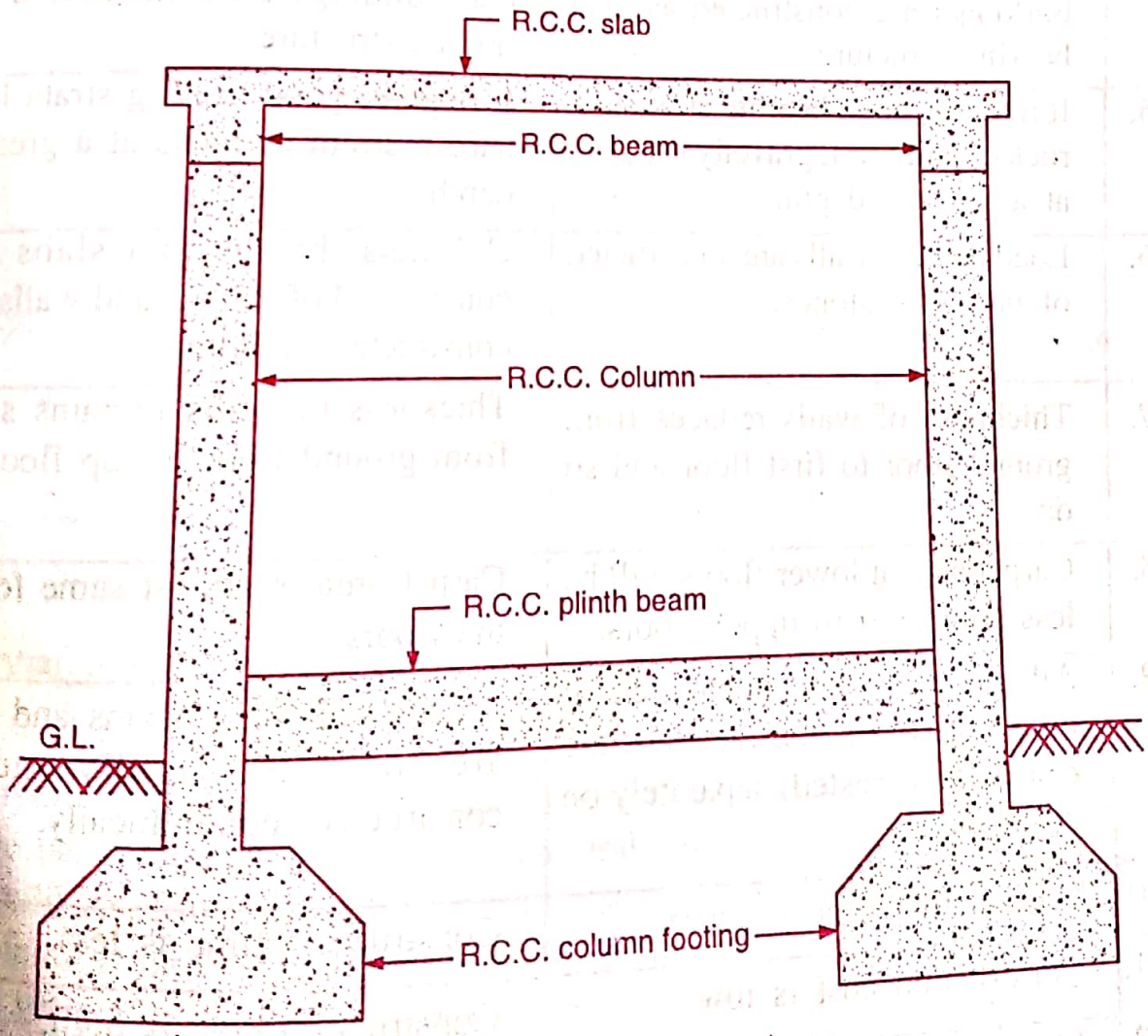


Fig. 7.2 Framed structure

Comparision of load bearing structure with framed structure :

(G.T.U., April 2010, June 2010, Jan. 2011, June 2011, June 2012, Winter 2014, Summer 2015)

	Load bearing structure	Framed Structure
1.	It is a structure comprising of slabs, beams and load bearing walls.	It is a structure comparising of slabs, beams and columns.
2.	Loads from the slab/roof or trusses and floors are transmitted through walls to the sub-soil below the ground through their foundations.	Loads from the slabs are transferred to the beams and beams rest over columns and whole load of the structure is transferred to the sub-soil below the ground through columns and their footings.
3.	In this structure all the walls are load bearings walls and bear loads and rest on foundations.	In this structure all the walls may or may not be partition walls and do not bear loads and rest on plinth beams.
4.	For up to three storey, residential buildings are constructed as load bearing structure.	Generally all multistored and high-rise buildings are constructed as framed structure.
5.	It requires good bearing strata like rocks, sandy soil, gravelly soil, etc. at a shallow depth.	It requires good bearing strata like hard murram or rocks at a greater depth.
6.	Load bearing walls are constructed of bricks or stones.	Columns, beams and slabs are constructed of R.C.C. and walls are constructed of bricks.
7.	Thickness of walls reduces from ground floor to first floor and so on.	Thickness of walls remains same from ground floor to top floor.
8.	Carpet area at lower floors will be less compared to upper floors.	Carpet area is almost same for all the floors.
9.	All the walls are constructed of bricks or stones and the slabs are constructed (casted) separately on the walls.	All the columns, beams and slabs are connected rigidly and are constructed monolithically.
10.	Construction time is more.	Construction time is less.
11.	Construction cost is low.	Construction cost is high.
12.	Life of structure is less.	Life of structure is more.

(iii) Composite structure :

The structure constructed with combination of both load bearing as well as framed structure is called composite structure. As shown in fig. 7.3 the load of slabs is transmitted to the sub-soil below ground by load bearing walls and columns through their foundations. In this type of structure external walls are treated as load bearing walls and all intermediate supports are in the form of R.C.C. columns. Composite structures are preferred for the buildings having large spans such as workshops, halls, warehouses, large factory sheds, godowns, etc. and have advantages of both load bearing structure as well as framed structure.

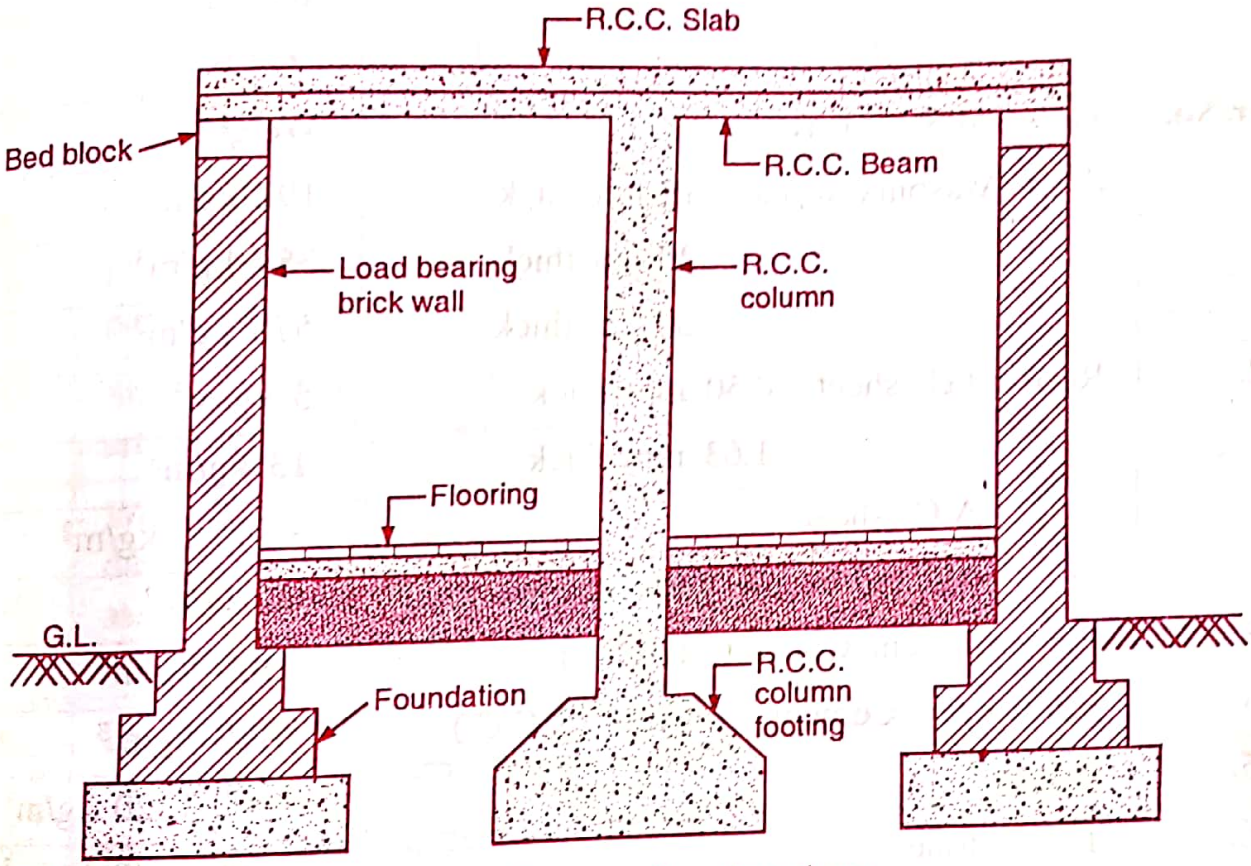


Fig. 7.3 Composite structure

7.3 TYPES OF LOADS ACTING ON BUILDINGS :

(G.T.U., Dec. 2008, June 2009, April 2010, June 2011, Winter 2013, Winter 2014)

Anything which exerts pressure or thrust on a structure is termed as load. The basic requirement of any structural component of a building is that it should be strong enough to carry or support all possible types of loads to which it is likely to be subjected. The loads coming on building foundations are generally divided into the following types :

(i) Dead load
(ii) Live load
(iii) Wind load
(iv) Snow load
(v) Load due to rain
(vi) Earthquake load

(i) Dead Load :

It is permanent, immovable and untransferable load of a structure. This is the load of the materials used for the various components of a building such as walls, floors, roofs, partitions, ceilings, water tanks, and shall include the weights of all other permanent constructions or structures and fixtures. All permanent loads are thus included in dead load. The dead load of floors, roofs, beams, ceilings, etc. is proportionately transmitted on the surrounding walls. Table 7.1 shows the weights of some of the common materials used in the construction of a building.

Table 7.1 : Dead Load of various materials

Sr.No.	Material/Structure	Weight
1.	Brick Masonry walls : 10 cm thick	192 kg/m^3
	20 cm thick	384 kg/m^3
	30 cm thick	576 kg/m^3
2.	Roof : G.I. sheet : 0.50 mm thick	5 kg/m^3
	1.63 mm thick	13 kg/m^3
	A.C. sheet	12-15.6 kg/m^2
	Mangalore tile with battens	63 kg/m^2
3.	Plain Cement Concrete (P.C.C.)	2300 kg/m^3
4.	Reinforced Cement Concrete (R.C.C.)	2400 kg/m^3
5.	Bricks	1600-1920 kg/m^3
6.	Lime stone	2400-2640 kg/m^3
7.	Sand stone	2240-2400 kg/m^3
8.	Timber	650-720 kg/m^3
9.	Steel	7850 kg/m^3
10.	Sand	1760-2000 kg/m^3
11.	Cement	1440 kg/m^3
12.	Water (fresh)	1000 kg/m^3
13.	Cement plaster, 25 mm thick	52 kg/m^2
14.	Clay (dry)	1440 kg/m^3
15.	Clay (damp)	1760 kg/m^3

(ii) Live Load :

This is the movable, temporary and transferable load on the floor and hence it is variable. In a building the weight of inhabitants, furniture or any other stored material, is the live load for that building. It is also sometimes known as the superimposed load. For the purpose of design an equivalent of dead load is taken into account.

Table 7.2 shows the live loads on floors.

Table 7.2 : Live loads on floors

Sr.No.	Type of Building	Minimum live load (Equivalent Dead Load) in kg/m^2
1.	Dwelling houses, hospitals, hostels	200
2.	Office floors, floors of light work rooms	250-400
3.	Floors of banks, offices and other public buildings	300
4.	Shop floors, reading rooms, art galleries, light garages	400
5.	Workshop floors, warehouses, dancing halls, waiting halls, assembly halls, cinemas, restaurants, gymnasia	500
6.	Floors of warehouses, factories and workshops (medium weight)	750
7.	Floors of warehouses, factories and workshops (heavy weight)	1000
8.	Staircases, corridors, passages	300-500
9.	Balconies	300-500

The live loads are assumed to be acting uniformly over the whole floor area and the total live load is proportionately distributed on the wall foundations for the purpose of design. The live load is assumed to act on all the floors of a building. In the case of multistorey buildings, some reduction is allowed in different floors as it is assumed that all the floors of a building are not simultaneously loaded. A percentage reduction is applied in the design of piers, columns, walls and foundations of a multi-storeyed buildings as shown in table 7.3 recommended by the Indian Standard Institution.

Table 7.3 : Reduction of superimposed loads

No. of floors carried by a member under consideration	Percent reduction of total live load on all floors above the member under consideration
1	0
2	10
3	20
4	30
5 to 10	40
above 10	50

(iii) Wind Load :

In case of tall buildings, the effect due to wind should be considered. Tall buildings are subjected to wind pressure on their exposed faces and inclined or slopy roof surfaces. The effect of wind pressure is to reduce the pressure on the foundation on the windward side and to increase the pressure on the foundation on the leeward side. For the purpose of design, it is assumed that the wind load is acting horizontally at a uniform rate over the entire exposed surface on the windward side.

Wind pressure

$$p = kV^2$$

where p = wind pressure in kg/m^2

V = Velocity of wind in km/hour

k = Coefficient whose value depends on various factors such as wind speed, temperature of air, shape of structure, etc.

= 0.0006 (as per building code)

If the height of a building is less than twice its effective width, the wind pressure may be neglected.

(iv) Snow Load :

Snow load acts on roofs. Actual load due to snow will depend upon the shape of the roof and its capacity to retain the snow. Roofs should be designed for actual loads due to snow or for the imposed loads, whichever is more severe. Mountainous regions in northern parts of India are subjected to snow fall. Load of snow maybe taken as 2.5 kg/m^2 per centimetre depth of snow. In case of roofs with slopes greater than 50° snow load may be disregarded

(v) Load due to rain :

On surfaces of roofs whose positioning , shape and drainage system are such as to make accumulation of rain water possible, load due to such accumulation of water and the live loads for the roofs shall be considered separately and the more severe of the two, shall be considered in the design.

(vi) Earthquake Forces (Loads) :

Earthquake causes shaking of the ground. So a building resting on it will experience motion at its base. The random earthquake ground motions, which cause the structure to vibrate, can be resolved in any three mutually perpendicular directions. The prominent direction of ground vibration is usually horizontal. The engineering intention is to make buildings earthquake resistance, such buildings resist the effects of ground shaking, although they may get damaged but would not collapse during the strong earthquake. Thus, safety of people and contents is assured in earthquake resistant buildings.

7.4 BUILDING COMPONENTS AND THEIR FUNCTIONS AND NOMINAL DIMENSIONS :

(GTU, Winter 2013)

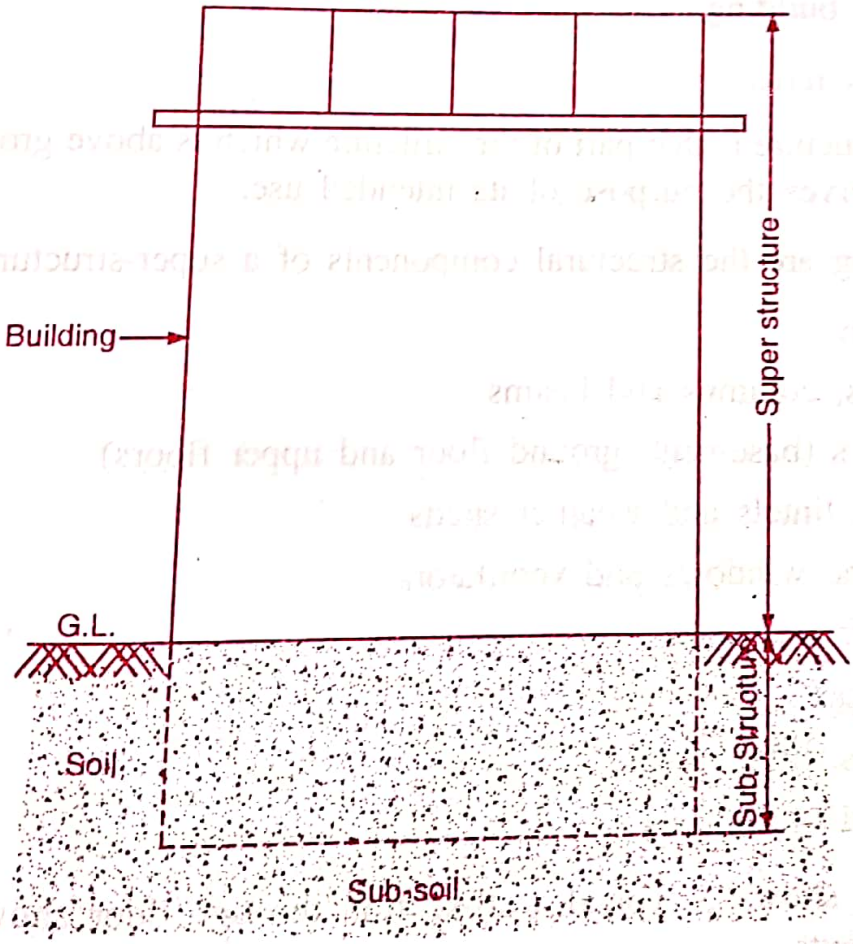


Fig. 7.4 Components of a building

A building has two main components : (G.T.U., March 2009)

(i) Sub-structure or foundations

(ii) Superstructure

The portion of the building below the surrounding ground is termed as sub-structure and the portion of the building above the ground is known as super-structure. (Fig. 7.4)

(i) Sub-structure or foundations :

Sub-structure or foundation is the lower portion of the building, usually constructed below the ground level, which transmits the loads of the super-structure to the sub-soil. The soil which is located immediately below the base of the foundation is called the sub-soil or foundation soil, while the lowermost portion of the foundation which is in direct contact with the sub-soil is called the footing. A foundation is therefore that part of the structure which is in direct contact with the ground to which the loads are transmitted. Thus, the basic function of a sub-structure or foundation is to transmit the dead loads, super-imposed loads (or live loads) and wind loads from a building to the soil on which the building rets. The foundation is thus the most important part of a building.

(ii) Super-structure :

Super-structure is that part of the structure which is above ground level, and which serves the purpose of its intended use.

Following are the structural components of a super-structure.

- Plinth
- Walls, columns and beams
- Floors (basement, ground floor and upper floors)
- Sills, lintels and weather sheds
- Doors, windows and ventilators
- Roofs and slabs
- Parapet
- Stairs, lifts, ramps,
- Building finishes

Fig. 7.5 shows a typical wall-section through door showing all building components. **(G.T.U., Dec. 2008, Dec. 2010, Jan. 2011)**

7.4.10 Building finishes :

The building finishes are used to give protective covering to the various building components against natural agencies and also they provide decorative effects.

The building finishes are plastering, pointing, painting, white/colour washing, varnishing, distempering, etc.

Summary :

Table : 7.4 Definitions of Building Components

Sr. No.	Building Component	Definition
1.	Foundation	It is the lowest part of a building or structure, which is in direct contact with the ground to which the loads are transmitted.
2.	Plinth	The portion of the building above ground upto the top of the floor immediately above the ground is known as plinth.
3.	Walls	The walls are constructed by the use of building units, such as bricks, stones, concrete blocks, etc. bonded together with mortar is termed as walls.
4.	Column	The column is an isolated vertical load bearing member of small section of concrete or stone or brick masonry.
5.	Sill	It is a horizontal structural member provided below the window opening.
6.	Door	A door is a framework of wood, steel, glass, aluminium or a combination of all the materials; secured in an opening left in a wall; for the purpose of providing access to the users of the structure.
7.	Window	A window is a framework of wood, steel, glass, aluminium or a combination of all the materials, secured in an opening, left in a wall, for the purpose of providing light and ventilation in a structure.
8.	Ventilator	A ventilator is a small window, secured in an opening, left in wall, for the purpose of providing ventilation in a room.

9.	Roof/Slab	A roof/slab is the uppermost part of a building to cover the space below.
10.	Beam	A structural member which carries lateral or transverse forces is termed as beam. It is provided below the slab and rested on walls or/and columns.
11.	Lintel	A lintel is a horizontal member which is placed across the opening of a door and a window.
12.	Stair	The stair is a series of steps arranged to connect the different floors of a building.
13.	Floors	The floor resting directly on the ground surface is known as ground floor and it is constructed at plinth level. The other floors of each storey, situated above the ground level are known as upper floors. Topmost floor is called terrace.
14.	Weathershed/ Chajja	It is projected small slab provided at lintel level above window, door, ventilator openings and verandah on outside of the external walls.
15.	Parapet	It is a low height, thin wall provided on external walls above slab to enclose open terrace.

Table : 7.5 Building Components and their functions

(G.T.U., June 2009, April 2010, Winter 2013, Summer 2014)

Sr. No.	Building Component	Functions
1.	Foundation	It transmits the load coming from the superstructure on to the subsoil below it.
2.	Plinth	It protects the building from rain water, damp or moisture, insects and transmits the load of superstructure to the foundation.
3.	Walls	The walls are provided to enclose or to divide the floor space into rooms as per requirement and also provide privacy, security and protection against sun, and rain, etc.
4.	Column	It transmits the load coming from the beams on the sub-soil below it.
5.	Sill	It supports window frame at bottom.
6.	Door	A door provides access into the room, offers privacy of sight and sound.
7.	Window	Window is an opening made in the wall for providing light and ventilation.
8.	Ventilator	A ventilator is a small opening made in the wall, provided at lintel level for the removal of exhaust air or foul gases.
9.	Roof/Slab	A roof/slab is the uppermost part of a building to cover the space below and protect it from sun, wind, rain and snow.
10.	Beam	Beams are media by which all loads of slab transferred to vertical supports (walls or columns) of a building.
11.	Lintel	It supports the weight of the wall above the openings of door, window and ventilator.
12.	Stair	It is the means of vertical transportation between the floors. It provides access between various floors.
13.	Floor	It provides plane surface and supports the occupants, furniture, fixtures and equipments of a building.
14.	Weathershed/ Chajja	Weathersheds or chhajjas are generally combined with lintels to protect doors, windows or ventilators from sun, rain, wind frost, etc.
15.	Parapet	Parapet acts as a protective solid balustrade for the users.

❖ OBJECTIVE TYPE QUESTIONS ❖

1. A structure comprising of slabs, beams and load bearing walls is known as
   (a) Load bearing structure (b) Framed structure
   (c) Composite structure (d) None of above

2. A structure comprising of slabs resting on beams and beams are supported by a network of columns is known as
   (a) Load bearing structure (b) Framed structure
   (c) Composite structure (d) None of above

3. The permanent, immovable and untransferable load of a structure is known as
   (a) Dead load (b) Live load (c) Snow load (d) Wind load

4. The movable, temporary and transferable load on the structure is known as
   (a) Dead load (b) Live load (c) Snow load (d) Wind load

5. The portion of the building below the surrounding ground is termed as
   (a) sub-structure (b) super-structure
   (c) sub-soil (d) none of above

6. The portion of the building which is above ground level is termed as
   (a) sub-structure (b) super-structure
   (c) sub-soil (d) none of above

7. The basic function of a foundation is
   (a) to transmit loads to the sub-soil
   (b) to provide stability
   (c) to check the settlement of a building
   (d) all above

8. If depth of foundation is equal to or less than its width is known as
   (a) shallow foundations (b) deep foundation
   (c) combined foundations (d) none of above

9. If depth of foundation is equal or greater than its width is called
   (a) shallow foundations (b) deep foundations
   (c) combined foundations (d) none of above

10. The portion of the building above ground upto the top of the floor immediately above the ground is known as
   (a) foundation (b) sill (c) plinth (d) ceiling

11. Which is the part of substructure out of the following? **[G.T.U., Winter 2013]**
   (a) Plinth (b) Foundation (c) DPC (d) Walls

12. (D)Depth of wall foundation is calculated by thumb rule (T = Wall thickness) **[G.T.U., Summer 2014]**
   (a) D is greater than equal to 2T+30
   (b) D is less than equal to 2T+30
   (c) D is greater than equal to T+30
   (d) None of the above

13. Which type of door provides maximum safety **[G.T.U., Summer 2014]**
   (a) Hollow core flush door (b) Solid core flush door
   (c) Sash door (d) Battened and ledged door

14. For span of 12 m which pitched roof can be suggested **[G.T.U., Summer 2014]**
   (a) King post (b) Queen post
   (c) Lean to roof (d) All of the above

15. A horizontal member placed across the opening of a door and a window is called
(a) Lintel (b) Chajja (c) Beam (d) Lintel with chajja

16. A horizontal structural member provided below the window opening is called
(a) Plinth (b) Lintel (c) Sill (d) Jamb

17. Thickness of partition wall is
(a) 10 cm (b) 20 cm (c) 30 cm (d) 40 cm

18. For span of 8m which pitched roof can be suggested ?
(a) King post (b) Queen post (c) Lean to roof (d) Steel roof

19. A low height, thin wall provided on external walls above slab is known as
(a) Portion wall (b) External wall (c) Internal wall (d) Parapet wall

20. Minimum plinth height provided for garages is
(a) 10 cm (b) 15 cm (c) 20 cm (d) 30 cm

(G.T.U., Winter 2014)

21. Snow load is
(a) Dead load (b) Live load
(c) Wind load (d) None of these

(G.T.U., Summer 2015)

22. Rainfall and snowfall is
(a) Dead load (b) Live Load
(c) Load on floors (d) None

: Objective Answers :

1. (a)	**2. (b)**	**3. (a)**	**4. (b)**	**5. (a)**	**6. (b)**	**7. (d)**
8. (a)	**9. (b)**	**10. (c)**	**11. (b)**	**12. (a)**	**13. (b)**	**14. (b)**
15. (a)	**16. (c)**	**17. (a)**	**18. (a)**	**19. (d)**	**20. (b)**	**21. (b)**
22. (b)						

❖ ❖ ❖

3.3. ELEMENTARY PRINCIPLES OF BUILDING PLANNING :

(G.T.U., Marh 2009, June 2009, June 2010, Dec. 2010, Jan. 2011, Dec. 2011, Sum.2013, Winter 2013, 2014, Sum.2015)

There are certain general principles or factors which an engineer should bear in mind while planning a building. While planning a building, the principles of planning should be considered in close association with the theoretical and practical aspects. All the principles may not be rigidly possible to adopt and there should be some scope of flexibility. These principles are of very general nature and they have to be applied on individual merits only. Following are general principles of planning :

1. Aspect
2. Prospect
3. Privacy
4. Grouping
5. Roominess
6. Circulation
7. Elegance
8. Flexibility
9. Sanitation
10. Economy and Practical considerations
11. Furniture requirement

Each of the above principles of planning will now be discussed briefly.

1. Aspect :

(G.T.U., Marh 2009, Sept. 2009, June 2010, April 2010, June 2011, June 2012, Winter 2013)

Different rooms of a building should be located as per their function utility keeping in view the direction of sun and wind. Rooms must get maximum advantages of these natural sources. A room which receives light and air from particular direction is said to have aspect of that direction. This is very important consideration in planning of building from comfort as well as hygienic considerations. Each room of a residential building particularly should have a particular aspect because certain rooms need morning sun whereas other rooms do need light at all.

Aspect of different rooms of a residential building for tropics are shown below in table 8.1.

Table 8.1 : Aspect

Type of room	Aspect
Kitchen	E
Dining room	S
Drawing room	S or SE, or NE
Bed room	SW, W or SE
Study room	N or NW
Store	N
Bath, W.C.	N or NE

These aspects can be achieved by proper planning a building and arranging doors and windows suitably.

2. Prospect :

(G.T.U., Mar. 2009, Sept. 2009, June 2010)

It gives how a building will look if it is viewed from outside, and placement of opening in the front wall to give aesthetic appearance and on one other hand should conceal some undesirable views. Doors and windows should be so located that pleasant and notable features are revealed and undesirable views concealed. One must feel the sense of pride in having a house which is pleasing in appearance and is reflecting its individuality. Some of the typical projecting type windows are shown in Fig. 8.2.

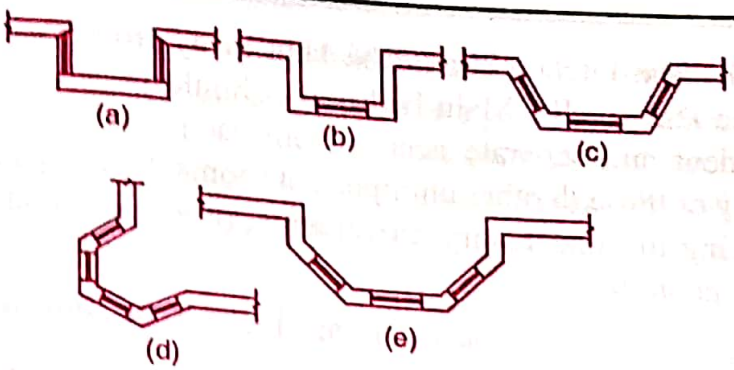


Fig. 8.2 Various types of projecting windows

3. Privacy : **(G.T.U., June 2011, Dec. 2011, Winter 2013, Winter 2014)**

This is one of the essential and important principle of planning. There should be privacy in individual room as part and a building as whole from other building. It is very essential for residential building particularly. We use curtains not only for beauty but also for privacy. In a residential building, the rooms should be so planned that privacy is maintained in all the rooms. Arrangement of doors and the way shutters are hung, privacy can be maintained as shown in Fig. 8.3.

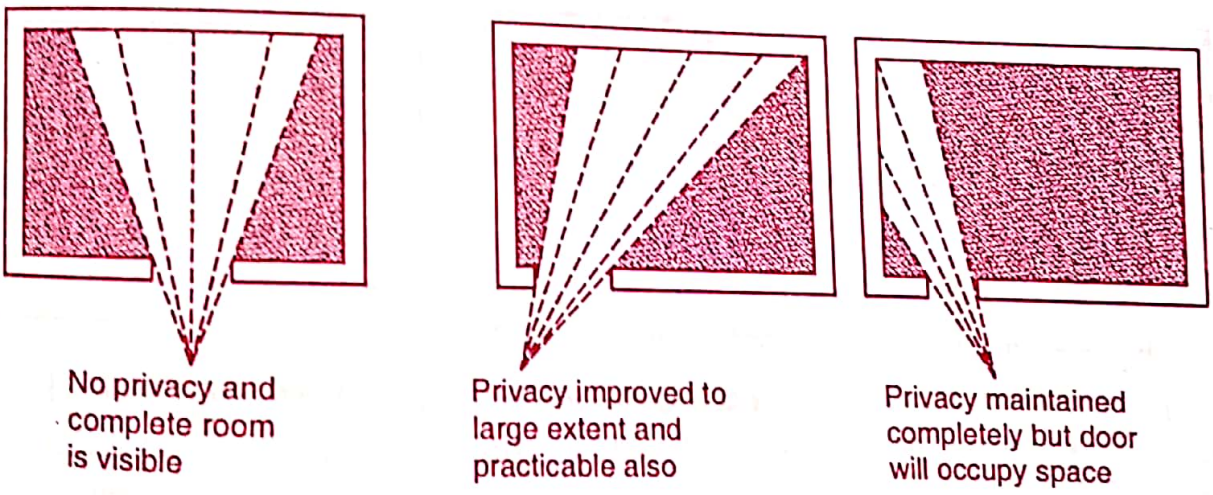


Fig. 8.3 Position of doors from privacy point of view

In case of residential buildings, privacy can be secured by carefully planning the entrance, proper grouping of all the rooms in their co-relation and by providing verandah, corridors or passages suitably. Study rooms need a privacy in the form of isolation so that not disturbed by other family members. In a residential building for bed rooms privacy must be maintained.

4. Grouping :

The placing of various rooms or units of a structure in proper correlation of their functions and in due proximity with each other is known as grouping.

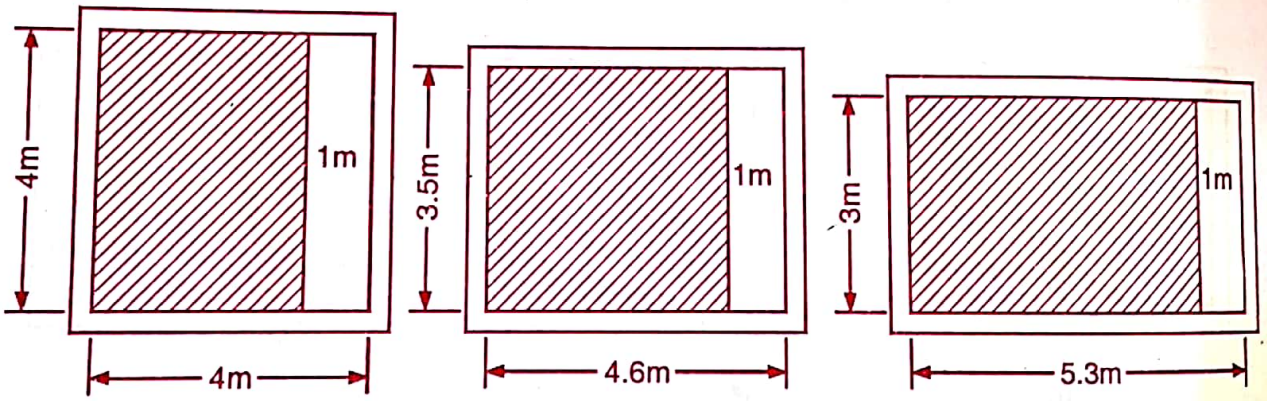
e.g. in a residential building, dinning room should be close to the kitchen.

At the same time kitchen should be kept away from main living room to avoid smoke and smells. Main bedrooms should be so located that there is an independent and separate access from each room towards the sanitary units directly or through other unimportant rooms. It is observed that grouping leads to saving in unnecessary movements, proper correlation, easy control and overall economy.

5. Roominess : **(G.T.U., April 2010, June 2011, June 2011, Dec. 2011, June 2012, Winter 2013)**

The term roominess is used to refer the effect derived from space of a room, i.e. its length, width and height. The rooms dimensions should be such that the maximum use of a room having minimum possible dimensions can be made.

Of course a square room costs minimum but it also has minimum usable area whereas a rectangular room will give more usable area. A length : width ratio should be 1.2:1 to 1.5:1. A room with length longer than 1.5 times its width will give a tunnel effect and hence should be avoided as shown in Fig. 8.4.



Square room
Usable area = 12m²
Perimeter = 16m

Rectangular room
L : B = 1.3:1
Usable area = 12.6m²
Perimeter = 16.2m
Looks beatitul

Rectangular room
L : B = 1.77:1
Usable area = 12.9m²
Perimeter = 16.6m
Looks ugly.

Fig. 8.4 Roominess

A oblong room with L:B ratio more than 1.5:1 gives more cost due to it perimeter being large and gives cramped effect. The height also plays significant role in developing the desired effect of roominess. A small roor with more height looks awkward. A large room has less ceiling height wi give very bad impression. In order to create an effect of closeness for building such as clubs, the ceiling heights may be kept low.

Hence room should have all dimensions proportional. Similarly utility of room can be increased by providing self, cupboards, etc.

6. Circulation : (G.T.U., Mar.2009, April 2010, Summer 2014, Winter 2014)

The term circulation or access is used to mean the link between the various rooms and floors of building. The proper provision of circulation makes the building comfortable and convenient. A room can be divided into two spaces, one is useful space and the other being circulation as shown in Fig. 8.5.

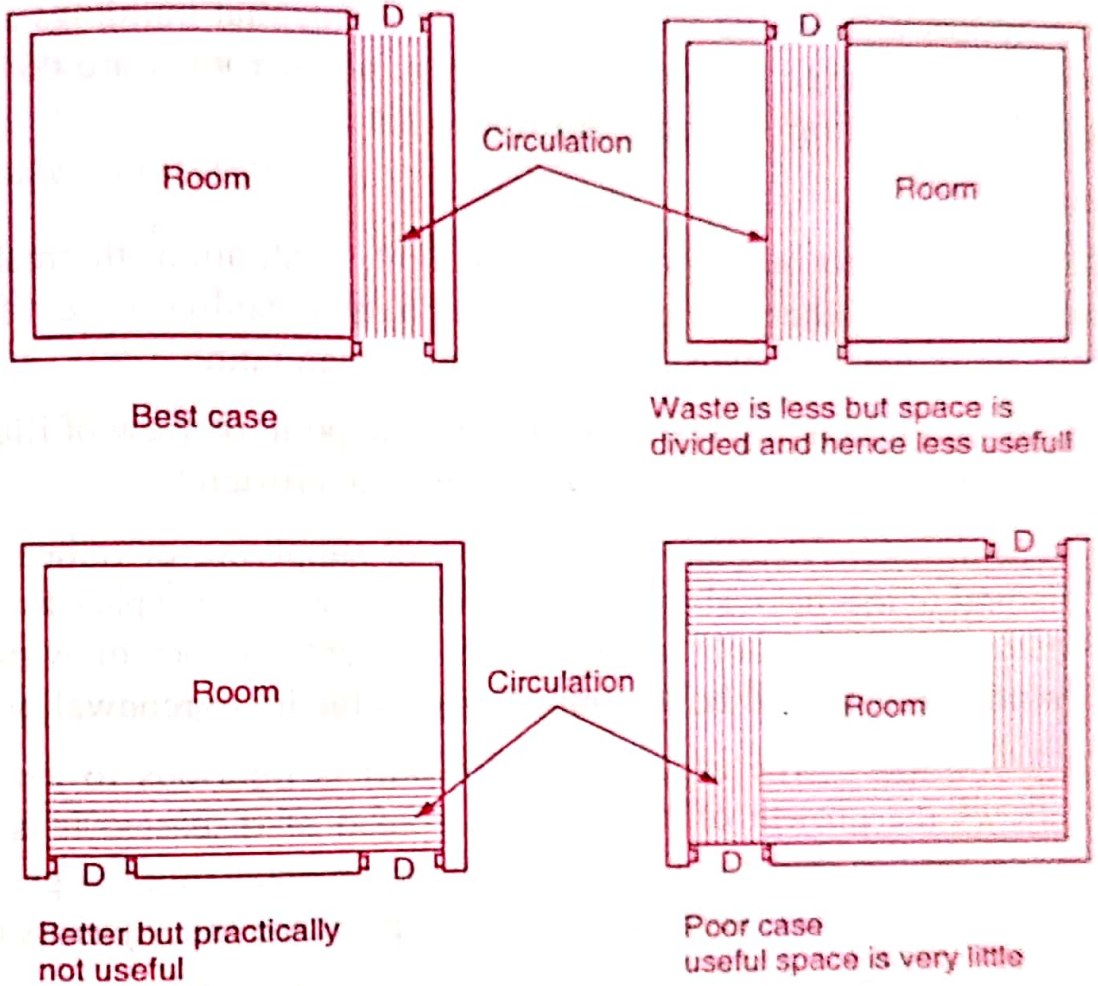


Fig. 8.5 Circulation

The ratio between circulation space to utilization space should be around 1:4 for economical planning. If the circulation is on the same floor, it is known as horizontal circulation and it includes verandah, passages, corridors, lobbies and halls. For vertical circulation about 8 to 10% of floor area of building is considered to be adequate. For achieving access to the upper floors, stairs or staircases or lifts are provided.

7. Elegance :

Elegance is related to the effect produced by elevation, which depends upon the proportion of width and height, positions of doors and windows, as also the choice of materials. The term elegance is used to indicate the architectural effect produced by elevation. Architectural design and composition should be studied in detail as a whole for achieving success in creating an elegant structure. The visualisation of elevation should always be kept in mind while preparing a plan.

8. Flexibility :

(G.T.U., Summer 2014)

It means a room should be so planned for one function that even if required it can be used for other. Present and future requirements of a family change as the family expands. Flexibility means planning the rooms in such a way which though originally designed for a specific purpose may be used for other purposes also as and when desired. In residential buildings also many times to arrange large gatherings of people; small rooms are converted to a big hall by shifting wooden partitions.

9. Sanitation :

Sanitation means to make provision for light, ventilation, thermal comfort consideration and other services. Sufficient light, cleanliness, ventilation and sanitary units are the main considerations in sanitation :

(i) **Lighting :** Lighting is important from the point of view of illumination and hygiene. Lighting may be natural or artificial.

(ii) **Ventilation :** Ventilation is a system of supplying or removing air by natural or mechanical means to or from any enclosed space to create and maintain comfortable conditions. Sufficient number of windows and ventilations should be accommodated to facilitate renewal of fresh air.

(iii) **Cleanliness :** The accumulation of dust is injurious to health and it allows the growth of bacteria and spread of diseases. It is therefore necessary to make the provision of ornamental mouldings, skirtings, cornices, etc. and give very plain treatment for the interiors of rooms.

(iv) **Sanitary units :** These include sanitary conveniences such as water closets, bath rooms, urinals, toilets, etc. water closets and bath rooms should be provided with dadoes so that they can be cleaned regularly.

10. Economy and practical considerations :

The economy may not be a principle of planning but definitely a factor affecting it. The building should have minimum floor area with maximum utility. It will reduce the cost and hence will be economical. Economy should not be achieved at the cost of strength otherwise the useful life of a building will reduce. Provision for future expansion, alteration may be considered if required.

11. Furniture requirement :

Furniture is the functional requirement of a room. Every room of a residential unit has to perform certain function for which necessary furniture items are required. It should be seen that placing, type, size and extent of such furniture items do not obstruct doors, windows and the circulation area. Thus the furniture requirements of various rooms should be considered while planning.

❖ OBJECTIVE TYPE QUESTIONS ❖

1. The arrangement of various rooms in the building is known as
(a) Plan (b) Elevation (c) Section (d) Details

2. The front view of a building is known as
(a) Plan (b) Elevation (c) Section (d) Details

3. A room which receives light and air from particular direction is called the
(a) aspect (b) prospect (c) privacy (d) Roominess

4. The placing of various rooms of a building in proper correlation of their functions is known as
(a) aspect (b) prospect (c) grouping (d) privacy

5. The effect derived from the dimensions of a room is termed as
(a) aspect (b) prospect (c) grouping (d) roominess

6. The link between the various rooms and floors of a building is known as
(a) aspect (b) prospect (c) circulation (d) grouping

7. The site of a residential building
(a) should be on fairly level ground (b) should be located on developed area
(c) should be connected by roods (d) all above

8. The setting of plan of the building on its site with reference to the directions is known as
(a) orientation (b) bye-laws (c) planning (d) drawing

9. Requirements of a building are :
(a) should be durable and stable (b) should be strong
(c) should be sufficiently ventilated (d) all above

10. Working drawings include the

(a) Plan (b) Elevation (c) Section (d) All above

11. As per principles of building planning-longer walls of building should face the direction: **[G.T.U., Summer 2014]**

(a) North-East (b) North-South (c) East-West (d) North-West

12. Functional areas include the following

(a) Living area (b) Sleeping area (c) Service area (d) All of the above

13. Minimum area required for W.C. is

(a) 1.0 m^2 (b) 1.1 m^2 (c) 1.2 m^2 (d) 1.3 m^2

14. Scale used for details is

(a) $\frac{1}{10}$ (b) $\frac{1}{50}$ (c) $\frac{1}{100}$ (d) $\frac{1}{500}$

15. Partition wall is provided between

(a) Kitchen and store (b) Drawing and dinning

(c) Bedroom and Verndah (d) Bath and W.C.

16. Plan is prepared by taking the cross section at **(G.T.U., Summer 2015)**

(a) Foundation level (b) Sill level

(c) Slab level (d) Lintel level

: Objective Answers :

1. (a) 2. (b) 3. (a) 4. (c) 5. (d) 6. (c) 7. (d)

8. (a) 9. (d) 10. (d) 11. (b) 12. (d) 13. (b) 14. (a)

15. (d) 16. (b)

❖ ❖ ❖